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MINERALOGY.—*Minasragrite, a hydrous sulphate of vanadium.* WALDEMAR T. SCHALLER, Geological Survey.

The blue efflorescence occurring on patronite at Minasragra, Peru, was found to be a sulphate of vanadium and was named after the locality. It occurs abundantly at Minasragra, according to Mr. D. F. Hewett,[1] and also is forming at the present time on many of the patronite specimens in museums. A large specimen of patronite in the United States National Museum had a considerable amount of the blue efflorescence on it and furnished the material for the present investigation.

In addition to the matrix minerals, such as patronite, quisqueite, and the nickelic pyrite, bravoite, the specimen shows as an efflorescence blue minasragrite, white tufts of prismatic crystals of morenosite, glassy green equidimensional crystals of melanterite, and clear bladed crystals of gypsum. All of the efflorescent minerals have clearly been derived from the oxidation and hydration of those forming the matrix.

No measurable crystals of minasragrite were observed, the mineral forming small mamillary masses and granular aggregates with drusy surfaces, generally distinct from the other sulphates but in places penetrated by masses of morenosite needles. Examined under the microscope, the minasragrite shows irregu-

[1] Personal communication. Abundant material, much purer than the original sample, has now been obtained and an analysis of this better material will be undertaken.

lar granular masses, indistinct short prisms, and rarely sharply defined units of a rhombic shape (angle about 78°). Some pieces break up into similar rhombs by cleavage, so that it may be that all the observed rhombs are cleavage pieces and not distinct crystals. From the general inclined extinction of all straight edges it is concluded that the mineral is monoclinic or triclinic.

TABLE 1

ANALYSIS OF MINASRAGRITE MIXED WITH IMPURITIES

	ANALYSIS	DISTRIBUTION				
		Minasragrite	Melanterite	Morenosite	Gypsum	Insoluble
V_2O_4	5.29	5.29				
FeO	0.97		0.97			
NiO	1.92			1.92		
CaO	0.46				0.46	
SO_3	10.92	7.12	1.08	2.06	0.66	
Insoluble	66.16					66.16
H_2O (by diff.)	14.28	9.06	1.68	3.24	0.30	
	100.00	21.47	3.73	7.22	1.42	66.16

TABLE 2

RECALCULATED ANALYSIS AND RATIOS OF MINASRAGRITE

	ANALYSIS	RATIOS	CALCULATED
V_2O_4	24.64	1.02 or 1×1.02	23.92
SO_3	33.17	2.86 or 3×0.95	34.58
H_2O	42.19	16.17 or 16×1.01	41.50
	100.00		100.00

The color of minasragrite is blue, the luster vitreous. The refractive indices are approximately as follows: $\alpha = 1.515$, $\beta = 1.525$, $\gamma = 1.545$. The pleochroism is strong: X = deep blue, Y = blue, Z = colorless. The mineral is optically negative.

Heated in a closed tube, minasragrite readily fuses and gives off water. It is very soluble in cold water. The sample scraped off for analysis necessarily contained all the minerals of the efflorescence, which were separated from the patronite by cold water. The water of the sample had to be expressed by differ-

ence, and the insoluble matter (mostly patronite) was air dried and not heated before weighing. The results of the analysis are given in table 1.

The analysis, with the insoluble matter and associated melanterite, morenosite, and gypsum deducted and recalculated to 100 per cent, is shown with the ratios in table 2.

The ratios yield the formula $V_2O_4 \cdot 3SO_3 \cdot 16H_2O$, which is interpreted as $(V_2O_2)H_2(SO_4)_3 \cdot 15H_2O$, minasragrite being a highly hydrated acid vanadyl sulphate. Quantitative determinations (by permanganate titrations) show that all of the vanadium in the mineral is in the tetravalent condition.

Several hydrates of acid vanadyl sulphate are known. The pentahydrate $(V_2O_2)H_2(SO_4)_3 \cdot 5H_2O$ is formed when the acid solution is evaporated on a water bath at about 90°, and it can be recrystallized from sulphuric acid at 100°. Lower hydrates are formed at higher temperatures.[2] It is therefore to be expected that at ordinary temperature a higher hydrate than the pentahydrate would form, and in minasragrite, formed at ordinary temperature, 15 molecules of water represent the extent of the hydration.

It is interesting to note that Gerland[3] reported a hydrate with 14 molecules of water, but later investigators have failed to find it. Possibly Gerland's 14-hydrate was identical with minasragrite.

[2] KOPPEL, J., and BEHRENDT, E. C. *Verbindungen des vierwertigen Vanadins.* Zeitschr. anorg. Chem., **35**: 154. 1903. Earlier references are cited by these authors. See also GAIN, GUSTAVE. *Sur quelques sulfates de vanadium tetravalent.* Comp. rend., **143**: 1154–1156. 1906.

[3] GERLAND, B. W. *Ueber einige Verbindungen des Vanadins.* Ber. d. Chem. Gesellsch., **9**: 869. 1876.

ZOOLOGY.—*The interrelationships of the subfamilies and genera included in the crinoid family Antedonidae.*[1] AUSTIN H. CLARK, National Museum.

Recently in the pages of this Journal[2] I proposed a rearrangement of the species of Antedonidae, distributing them among forty genera, which in turn were grouped in seven subfamilies.

In the following keys the interrelationships of the subfamilies, and of the genera within each, are shown.

Family ANTEDONIDAE Norman (emended)

Key to the Subfamilies of the Family Antedonidae

Cirrus sockets arranged in definite columns on a conical or columnar, usually large, centrodorsal.....ZENOMETRINAE

Cirrus sockets arranged in transverse alternating rows, or irregularly, on a hemispherical to discoidal or conical centrodorsal.

The segments of the genital pinnules are much expanded, forming a roof over the gonads.....ISOMETRINAE

The segments of the genital pinnules are not expanded.

P_1 is composed of numerous (usually more than 50 and never less than 30) short segments of which at least the first six or seven, and usually nearly all, are broader than long, and the distal are rarely more than twice as long as broad; P_1 is about as long as, or longer than, P_2.

One or more of the following pinnules resembles P_1. HELIOMETRINAE

P_2 and the following pinnules are composed of segments which, beyond the third or fourth, are much elongated.....THYSANOMETRINAE

P_1 is composed for the most part of much elongated segments, though a few of the basal segments may be short; the distal segments are at least twice as long as broad.

The distal cirrus segments are entirely without dorsal processes on their distal ends; the cirri are usually (but not always) short, rarely with more than 20, never with more than 30, segments..ANTEDONINAE

The distal cirrus segments always have the distal dorsal edge prominent, with the median portion more or less produced in the form of a dorsal spine, and the mid-dorsal line more or less strongly carinate.

[1] Published with the permission of the Secretary of the Smithsonian Institution.

[2] Journ. Wash. Acad. Sci., 7: 127–131. 1917.

P_2 resembles P_1, and always differs from the genital pinnules; P_a is frequently, and P_1 occasionally, absent.....PEROMETRINAE

P_2 resembles P_3 and the succeeding pinnules, and often bears a more or less developed gonad; all of the lower pinnules are invariably present.....BATHYMETRINAE

Subfamily ANTEDONINAE A. H. Clark

Key to the Genera of the Subfamily Antedoninae

P_2 of the same length and character as P_3 and the following pinnules, and much shorter than (usually about half as long as) P_1.

Pinnule segments with unmodified, or at the most with very finely spinous, distal edges; size medium, the arms rarely under 45 mm. in length (*Norway to the Gulf of Guinea, including the entire Mediterranean basin and the east Atlantic Islands; Caribbean Sea to Rio de Janeiro, Brazil;* 0–445 *meters*).....**Antedon**

Pinnule segments with strongly produced, everted and coarsely spinous distal edges; size small, the arms never over 70 mm. and rarely over 45 mm. in length (*Southern coasts of Australia northward throughout the East Indian region to southern Japan;* 0–275 *meters*).....**Compsometra**

P_2 not of the same length and character as P_3 and the following pinnules, and never only half as long as P_1.

P_3 of the same length and character as the succeeding pinnules.

Centrodorsal flattened hemispherical or discoidal; size medium, the arms being between 60 mm. and 120 mm. in length; P_1 has 18–40 segments.

P_1 longer than the cirri, becoming very slender and flagellate distally, composed of about 40 segments (*Ceylon to the Society Islands;* 0–47 *meters*) **Mastigometra**

P_1 shorter than the cirri, less slender and more or less stiffened, composed of 18–21 segments (*Moluccas to China, and eastward to the Society Islands;* 0–397 *meters*).....**Euantedon**

Centrodorsal conical; size small, the arms being about 30 mm. in length; P_1 and P_2 have 12–13 segments (*Hawaiian Islands and northern New Zealand;* 108–293 *meters*).....**Argyrometra**

P_3 not of the same length and character as the following pinnules.

P_3 much the longest and stoutest pinnule on the arm.

The distal ends of the cirrus segments do not overlap the bases of those succeeding; the dorsal edge of the outer four to six cirrus segments is about as long as the proximal border; the brachials have

strongly produced and coarsely spinous distal edges (*Flores to Borneo and the Philippine Islands;* 0–502 *meters*) ..... **Toxometra**

The cirrus segments have produced distal ends which overlap the proximal ends of those succeeding; the outer cirrus segments are much longer than their proximal width; the brachials have smooth, or only very finely spinous, distal edges.

Smaller, with not over 16 cirrus segments; cirri less numerous, XX–XLV (rarely over XL); arms 23 mm. to 50 mm. long (*From the Red Sea to Madagascar and Mauritius, eastward to northern Australia and the East Indies, and northward to southern Japan;* 0–106 *meters*) **Dorometra**

Larger, with 16–33 cirrus segments; cirri more numerous, XXXV–LX (rarely less than XL); arms 75 mm. to 80 mm. long (*Lesser Sunda Islands to the Philippines;* 69–140 *meters*) **Eumetra**

P_3 not much the longest and stoutest pinnule on the arm.

P_1, P_2, and P_3 similar and of approximately equal length, with at least 13 segments.

P_1, P_2, and P_3 longer than the genital pinnules; the pinnules are not especially stiffened, and their component segments do not bear prominent spines on the distal edges; the centrodorsal is low hemispherical (*Philippine Islands to southern Japan;* 23–192 [?250] *meters*) **Iridometra**

P_1, P_2, and P_3 shorter than the genital pinnules; all the pinnules slender and stiff, especially the lower which are thorn-like with long spines on the distal edges of the segments; the centrodorsal is large, rounded conical (*Coast of Brazil;* 41 *meters*) ..... **Hybometra**

P_2 much longer than P_1, and longer than P_3, though similar to the latter; centrodorsal more or less sharply conical (*Andaman Islands to southern Japan;* 54–201 [?250] *meters*) ..... **Andrometra**

Subfamily THYSANOMETRINAE A. H. Clark

Key to the Genera of the Subfamily Thysanometrinae

P_2 with the third segment as long as, or longer than, broad, and the following segments markedly longer than broad (*Southern Japan and the Admiralty Islands;* 126–355 *meters*) .... **Thysanometra**

P_2 with the third segment broader than long, and the fourth broader than long, or about as long as broad (*Caribbean Sea, and northward to North Carolina;* 13–1029 *meters*) ..... **Coccometra**

Subfamily PEROMETRINAE A. H. Clark

Key to the Genera of the Subfamily Perometrinae

P_1 and P_a absent; size small, the 10 arms being from 25 mm. to 35 mm. (usually between 25 mm. and 30 mm.) in length; cirri XX–XXX, 22–25, 10 mm. long (*West Indies;* 59–433 *meters*) **Hypalometra**

P_1 always present, though P_a (on the inner distal end of the first syzygial pair) is sometimes absent.

Ossicles of the IBr series and first two brachials with smooth and unmodified depressed borders, laterally in close apposition with their neighbors and sharply flattened against them; synarthrial tubercles (on the articulations between the elements of the IBr series and first two brachials) very prominent, sometimes extravagantly developed; P_1 is as long as, longer than, or shorter than, P_2; P_a may be absent; 10–14 (usually 10) arms from 35 mm. to 90 mm. long 28–55 cirrus segments (*From Madagascar to the Kei Islands and southern Japan;* 70–252 [?273] *meters*) ..... **Perometra**

The ossicles of the IBr series and first two brachials may be just in contact laterally, but their sides are never sharply flattened, and prominent synarthrial tubercles are never developed; their lateral borders always bear tubercles, one or many to each ossicle, and their distal and proximal borders are usually prominently everted and tubercular.

Interbrachial portions of the perisome naked; P_a always present (*Kei Islands and southern Japan;* 204–344 *meters*) **Nanometra**

Interbrachial portions of the perisome with numerous prominent rounded calcareous nodules which are not in lateral contact; P_a usually absent (*Moluccas and southern Japan;* 99–270 *meters*) ..... **Erythrometra**

Subfamily HELIOMETRINAE A. H. Clark

Key to the Genera of the Subfamily Heliometrinae

10 radials and 20 arms (*coasts of the Antarctic continent, and Kerguelen Island;* 18–400 *meters*) ..... **Promachocrinus**

5 radials and 10 arms.

Each brachial bears a high median carinate process; P_1 much longer than P_2 (*Coasts of the Antarctic Continent;* 223–400 [?900] *meters*) ..... **Anthometra**

No carinate processes on the brachials.

Brachials very short, much broader than long; middle and

distal pinnules with very short segments which are rarely longer than broad; cirrus segments very short, only very few, or none at all, longer than broad; P_1 and P_2 of approximately the same length (*Vicinity of Heard Island, and the winter quarters of the "Discovery;"* 135–270 *meters*) ..... **Solanometra**

Brachials longer, about as long as broad or slightly longer than broad; segments of the middle and distal pinnules longer than broad, usually very much so; a number of the earlier cirrus segments longer than broad.

P_1 with 30–45 segments of which those beyond the seventh to eleventh are longer than broad, the distal elongate, though never much more than twice as long as broad; P_2 is similar to P_1, but shorter (*Arabian Sea to southwestern Japan;* 192–2160 *meters*) ..... **Cyclometra**

P_1 with 50–100 segments of which only the terminal are longer than broad, and those only very slightly so; P_2 is similar to P_1, and usually of about the same length.

Brachials with smooth distal edges; ossicles of the division series with smooth borders and a smooth dorsal surface; no rudimentary terminal comb on the proximal pinnules (*Arctic Ocean, and southward to Norway and Nova Scotia; western shores of the Okhotsk and Japanese Seas from Cape Terpenia to Korea;* 12–1340 *meters*) ..... **Heliometra**

Brachials with spinous distal edges; ossicles of the division series with usually spinous borders and commonly with a greater or lesser development of spines on the dorsal surface; the proximal pinnules bear a rudimentary terminal comb suggesting that found in the species of the Comasteridae (*From Cape Horn northward along the western coast of South and North America to Alaska, thence westward and southward to southern Japan;* 11–1911 *meters*). **Florometra**

The genus *Heliometra* includes only the well known *Heliometra glacialis* (Leach) (= *Antedon eschrichti* [J. Müller] of P. H. Carpenter and earlier authors generally).

Anthometra, *Solanometra*, and *Florometra* are best considered as subgenera of *Promachocrinus*. A full account of the first two

and the last will be found in my memoir on Die Crinoiden der Antarktis.[2]

Subfamily ZENOMETRINAE A. H. Clark

Key to the Genera of the Subfamily Zenometrinae

P_1 and P_a absent (*Philippine Islands;* 140–148 *meters*) . . . . . **Balanometra**

P_1 and P_a present.

Cirri with all the segments elongated, the distal entirely without dorsal processes; or (very rarely) a few of the outermost cirrus segments may be but little longer than broad with slight dorsal tubercles.

Cirrus sockets arranged in closely crowded columns in each radial area; but the groups of columns in each radial area are usually (almost invariably) separated from the groups of columns in the adjacent radial areas by long triangular bare patches; the distal cirrus segments are always greatly elongated, never with any trace of dorsal processes (*From the Galápagos Islands and Panama northward to the Aleutian Islands, and southward on the Asiatic coast to Yezo Strait and the northern part of the Sea of Japan; the Hawaiian Islands; the Philippine Islands; the Lesser Sunda Islands; the Bay of Bengal and the coast of Travancore, and southward to the Antarctic regions;* 336–2858 *meters*)

Psathyrometra

Columns of cirrus sockets somewhat irregular, and evenly spaced all around the centrodorsal without differentiation into radial groups; the distal cirrus segments may be much elongated with no trace of dorsal processes, or little, if any, longer than broad, with slight dorsal tubercles (*From the western coast of Scotland, and Ireland, southward to Madeira, including the entire Mediterranean basin;* 45–1292 *meters*) . . . . **Leptometra**

Cirri with the proximal segments more or less elongated, but the distal segments short, never longer than broad, and bearing prominent dorsal processes.

Division series and arm bases smooth; 10–14 arms (*Kei Islands and northern Cuba;* 252–380 *meters*)

Adelometra

Division series and arm bases spiny.

Size large; cirri with more than 40 (50–60 segments; columns of cirrus sockets very regular, separated interradially by high ridges, or by broad bare areas.

Two columns of cirrus sockets in each radial area,

[2] Deutsche Südpolar-Expedition, **16** (Zoologie, **8**), May 16, 1915, pp. 120–143.

the radial areas being separated by high ridges (*From St. Lucia, British West Indies, northward to Georgia and Pensacola, Florida; 304–792 meters*) ..... **Zenometra**

Three columns of cirrus sockets in each radial area, the radial areas being separated by broad bare areas (*Hawaiian Islands; 346–633 meters*). **Sarametra**

Size small; cirri with less than 30 segments; columns of cirrus sockets on the centrodorsal slightly irregular; interradial areas on the centrodorsal not especially differentiated (*Marion Island, and the shores of the Antarctic continent in the vicinity of Gaussberg; 252–400 meters*) ..... **Eumorphometra**

Subfamily ISOMETRINAE A. H. Clark

The only genus in this subfamily is *Isometra*, of which a complete account will be found in *Die Crinoiden der Antarktis*, pp. 145–146.[4]

Subfamily BATHYMETRINAE A. H. Clark

Key to the Genera of the Subfamily Bathymetrinae

All the cirrus segments short, the longest not so much as twice as long as the median diameter.

Cirrus segments cylindrical, without expanded distal ends, 25–33 (usually nearer the latter) in number, the longest (third-fifth) about one-third again as long as broad, those beyond the eighth about as long as broad, the distal slightly broader than long; IBr series and arm bases without lateral processes, and widely free laterally (*Western coast of Ireland; 698 meters*) ..... **Orthometra**

Cirrus segments with much swollen distal ends, not more than 20 in number; IBr series and brachials in close lateral contact (*Moluccas to Marion Island, southeast of Africa; 1089–2880 meters*) ..... **Tonrometra**

Proximal cirrus segments elongated, at least twice as long as the median diameter, and usually much longer.

Centrodorsal sharply conical with straight sides, nearly or quite as long as broad at the base (*Philippine Islands to Celebes; 509–1901 meters*) ..... **Fariometra**

Centrodorsal less sharply conical, with rounded sides, or hemispherical, and lower.

All the brachials have strongly produced and very spinous edges; P_1 very slender and delicate, markedly longer than P_2, with the outer segments very greatly elon-

[4] Deutsche Südpolar-Expedition, **16** (Zoologie, **8**), May 16, 1915.

gated with overlapping and spinous distal ends (*From southern Japan, the Hawaiian and Philippine Islands westward to Cape Comorin, thence southwestward to between Marion Island and the Crozets; from the Bay of Biscay northward to 54° 17′ N. lat., and from Brazil northward to the Newfoundland banks;* 248–2926 *meters*) **Trichometra**

The brachials do not have strongly produced and very spinous distal ends; at most the distal edges of the outer brachials are bordered with fine spines.

P_1 much elongated, between two and three times as long as P_2, composed of 30–40 segments of which a few of the basal are short, the following becoming slender and greatly elongated (*Arctic Ocean from western Greenland to the Kara Sea, and southward to Portugal and Chesapeake Bay, and also in the vicinity of Marion Island, southeast of South Africa;* 18–1800 *meters*) ..... **Hathrometra**

P_1 the same length as, longer than, or shorter than, P_2; but if longer never more than slightly so, and with not more than 20 segments.

Cirri with 20–30 relatively short segments of which the last six to thirteen are only very slightly, if at all, longer than broad.

Pinnules not especially long; distal pinnules the same length as the proximal pinnules; P_2 resembling P_3 and the following pinnules, slightly longer and stouter than P_3 with somewhat fewer segments which are proportionately longer; P_2 may bear a gonad, though these usually begin on P_3; arms 25 mm. to 60 mm. long; cirri L-LX, 21–30 (*Kei and Meangis Islands, and southern Celebes;* 204–1158 *meters*) **Nepiometra**

Pinnules very long; distal pinnules not so long as the proximal pinnules; P_2 very slightly shorter than P_1, but similar to it, with about 18 elongated segments; following pinnules similar; arms about 20 mm. long; cirri about XXX, 20–25 (*Southeastern South America;* 1080 *meters*) **Phrixometra**

Cirri with not more than 20 much elongated segments all of which are markedly longer than broad, especially the proximal.

More than XXV cirri, which have 10–20 segments (*Eastern Pacific, including the Seas*

of Okhotsk and Japan, from western Bering Sea to the Kermadec Islands and New Zealand, and westward to between Marion Island and the Crozets; southwest of Iceland; 144–3178 *meters*) . . **Thaumatometra**

Not more than XV cirri, which have not more than 10 segments (*Abysses of the Pacific from west of Tasmania to west of Japan;* 4680–5220 *meters*) . . . . . **Bathymetra**

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. Each of the scientific bureaus in Washington has a representative authorized to forward such material to this JOURNAL and abstracts of official publications should be transmitted through the representative of the bureau in which they originate. The abstracts should conform in length and general style to those appearing in this issue.

GEOLOGY.—*The enrichment of ore deposits.* W. H. EMMONS. U. S. Geol. Survey Bull. 625. Pp. 530. 1917.

This report is an amplification of an earlier Survey bulletin on the enrichment of sulphide ores (Bulletin 529). Fifteen elements and their compounds not considered in the earlier report are discussed with reference to their reactions in the zone of oxidation. All recent important advances in the subject have been incorporated and the general treatment has been considerably broadened.

The geologic conditions favorable and unfavorable to the formation of enriched mineral deposits are described and the criteria by which such deposits may be recognized are outlined. The natural chemical processes by which enrichment is produced are fully discussed and the behavior of each metal is considered separately and is illustrated by descriptions of many of its known valuable enriched ore bodies. A. K.

GEOLOGY.—*Notes on the greensand deposits of the eastern United States.* GEORGE H. ASHLEY. U. S. Geol. Survey Bull. 660-B. Pp. 27–58. 1917.

No attempt was made at a detailed survey of the greensands but samples were collected from the most accessible of the deposits and analyzed to determine their percentage of potash. The results of the study show that the richest and largest deposits of greensand occur in New Jersey, extending down into Delaware. Lower grade greensands occur abundantly in Maryland and less abundantly in Virginia, North Carolina, Arkansas, Texas, and doubtless the other Southern States.

The richest deposits show a potash content around 7 per cent,

which is close to the percentage of potash in glauconite, of which the best greensands are almost entirely made up. These greensands occur in the basal part of the Cretaceous formation of New Jersey and Delaware and in the upper part of the Eocene. Those of New Jersey are entirely in the Cretaceous, while those of Maryland are in both Cretaceous and Eocene.

The paper also contains a contribution on *Methods of analysis of greensands* by WILLIAM B. HICKS and REGINALD K. BAILEY, discussing the methods used in making these analyses, which differ somewhat from methods previously used. G. H. A.

GEOLOGY.—*The Irvine oil field, Estill County, Kentucky.* EUGENE W. SHAW. U. S. Geol. Survey Bull. 661-D. Pp. 141–191. 1917.

The report outlines the history of the Irvine oil field, which in three years has developed into the richest oil territory in the state, and describes the geology, including the nature and lay of the rocks, the character and occurrence of the oil, and other features of the field. The report contains one map, 20 by 30 inches, showing the structural geology, farm lines, wells, and other features on a scale of 2 miles to the inch, and another map showing the general geologic structure of about 1000 square miles surrounding the field on a scale of 4 miles to the inch.

The Irvine oil field is by far the most productive yet developed in Kentucky. In fact, its output in 1917 will be more than twice as great as that of the dozens of other oil fields in the State, some of them long productive; and it will probably produce much more in 1918. The field is in a region where oil showings have long been known and oil has long been sought, and yet somehow this great pool 10 miles long and 2 miles wide was missed. The west side of the Irvine field is within a mile of outcrops of the oil-bearing bed, which may be seen at several places in and around Irvine. Some of the wells are less than 100 feet deep and yet furnish good yields, even the oldest showing a relatively low rate of decline. E. W. S.

GEOLOGY.—*Geology and ore deposits of the Mackay region, Idaho.* JOSEPH B. UMPLEBY. U. S. Geol. Survey Prof. Paper 95. Pp. 129. 1917.

The Mackay region is in southeastern Idaho north of Snake River. It has yielded about $3,750,000, of which $2,300,000 has come from copper, and the remainder from silver, lead, and gold.

The older formations of the region comprise more than 20,000 feet of strata ranging in age from Algonkian to Pennsylvanian. These rocks were intruded by large masses of granite in late Cretaceous or early Eocene time. Great volumes of andesite lava flooded a system of deep valleys in Miocene time, and extensive outpourings of basalt during the Pliocene have covered parts of the region.

The principal ore bodies are contact-metamorphic copper deposits. They are of particular scientific interest because they appear to have been formed by gaseous transfer from a granite magma, during which large quantities of iron, aluminum, silicon, copper, and sulphur were supplied to the contact rocks. The geologic relations are unusually favorable and allow almost rigorous proof that the ore-depositing solutions were of magmatic origin. The copper deposits are highly oxidized, and chrysocolla is the main constituent. Many of the features of the oxidized ores appear to be of colloidal origin, and the prevalent microscopic banding is probably due to rhythmic precipitation in gelatinous media (the Liesegang effect). A. K.

GEOLOGY.—*The Newington moraine, Maine, New Hampshire, and Massachusetts.* FRANK J. KATZ and ARTHUR KEITH. U. S. Geol. Survey Prof. Paper 108-B. Pp. 11–29. 1917.

A recessional moraine consisting of several separate segments disposed along a sinuous course lies near the Atlantic coast and has been traced through 60 miles from Saco, Maine, to Newbury, Massachusetts. It is for the most part about or less than 100 feet above sea level but rises to 180 feet in Biddeford, Maine, 150 feet in Dover, New Hampshire, and Newburyport, Massachusetts, and is between 200 and 250 feet above the sea in Wells and South Berwick, Maine. Although not more than 40 to 100 feet higher than surrounding Pleistocene formations, nevertheless it is topographically prominent because it is in a region of slight relief. The moraine rests upon and is surrounded by a floor of ice-smoothed rock and of till. The region was submerged during the building of the moraine, and the ice front stood in the sea. The moraine is the result of the accumulation of glaciofluvial detritus discharged directly into the sea; consequently in some places it is built up as broad, flat, delta-like plains of sand and gravel. Clay ("Leda clay") was continuously deposited in the sea, both while the moraine was accumulating and after the ice retreated from the moraine, so that the younger clay beds in some places overlie the

moraine. This clay is the fine glacial outwash. The moraine and the marine clay probably belong to a late Wisconsin substage of the Pleistocene epoch. F. J. K.

BOTANY.—*Grasses of the West Indies.* A. S. Hitchcock and Agnes Chase. Contributions from the U. S. National Herbarium, **18**: 261–471. 1917.

The paper is a descriptive list of 110 genera and 455 species of the grasses of the West Indies. For the purposes of the list the West Indies includes Bermuda, the Bahamas, Trinidad, and Tobago but excludes the Dutch Islands off the coast of Venezuela. There are keys to the tribes and genera and keys to the species of each genus. The genera and species are briefly described and under each species is given full synonymy, the habitat, geographical range, the common names, and the locality from which the species and the synonyms were described (the type localities). An attempt has been made to account for all the species credited to the West Indies. One genus and 14 species are described as new. Appended to this list is a catalogue of all the specimens in the U. S. National Herbarium, arranged by collectors' names and numbers. A. S. H.

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